

## CLAIMS

What is claimed:

1. A method for distributing cryptographic requests to a plurality of cryptographic devices comprising:

receiving a cryptographic request;

determining the lowest  $T(N)$ ; and

sending the request to a cryptographic device with the lowest  $T(N)$ .

2. The method of claim 1 further comprising:

determining whether there is a second cryptographic request; and

responsive to a determination that there is a second cryptographic request, determining a new lowest  $T(N)$ ; and

sending the second cryptographic request to a device with the new lowest  $T(N)$ .

3. The method of claim 1 further comprising:

setting  $N$  equal to 1;

setting  $T(N)$  equal to 0;

setting  $Q(N)$  equal to 0;

determining whether there is another device to query; and

responsive to a determination that there is another device to query, setting  $N$  equal to  $N$  plus

1 and returning to the step of setting  $T(N)$  equal to 0.

4. The method of claim 1 further comprising:

setting CT equal to CST; and  
updating all estimated QI completion times.

5. The method of claim 1 further comprising:

setting ET from an ET table;  
determining whether a QI is the only QI in queue; and  
responsive to a determination that the QI is the only QI, setting the QI timestamp to CT.

6. The method of claim 1 further comprising:

setting N equal to 1;  
determining whether Q(N) is empty;  
responsive to a determination that Q(N) is empty, determining whether there is another device;  
responsive to a determination that there is another device, setting N equal to N plus 1 and  
returning to the step of determining whether Q(N) is empty;  
computing t where t is the time a request in a QI at the top of a queue has been processing,  
by subtracting the time stamp from CT;  
subtracting t from the QI's estimated completion time;  
determining whether the new estimated completion time is less than or equal to zero;  
responsive to a determination that the new estimated completion time is less than or equal  
to zero, setting the estimated time to Z percent of the original estimated time.

7. The method of claim 1 further comprising:

identifying a cryptographic device associated with a QI with a completed request;  
determining whether there are more QI's in queue for the cryptographic device; and  
responsive to a determination that there are more QI's in queue for the cryptographic device,  
calculating the current system time and assigning the current system time to the next QI's timestamp

8. A programmable apparatus for balancing the load of requests for cryptographic operations sent to a plurality of identical cryptographic devices comprising:

a computer having a processor, a memory, a plurality of PCI buses, and a plurality of cryptographic devices connected to said PCI buses;

a cryptographic API installed on said computer;

a loading balancing program in said cryptographic API;

a estimated completion time subroutine in said load balancing program;

wherein, said estimated completion time subroutine directs said processor to determine a lowest  $T(N)$ ; and

wherein, responsive to determining a lowest  $T(N)$ , sending a request for a cryptographic operation to a device with the lowest  $T(N)$ .

9. The programmable apparatus of claim 8 further comprising an initialization subroutine in said load balancing program that directs said processor to set  $N$  equal to 1, set  $T(N)$  equal to 0, set  $Q(N)$  equal to 0.

10. The programmable apparatus of claim 8 further comprising a subroutine in the load balancing program that sets CT equal to CST and updates all estimated QI completion times.

11. The programmable apparatus of claim 8 further comprising a subroutine in the load balancing program that sets ET from an ET table, determines whether a QI is the only QI in queue, and responsive to a determination that the QI is the only QI, sets the QI timestamp to CT.

12. The programmable apparatus of claim 8 further comprising a subroutine in the load balancing program that computes t where t is a time a request in a QI at a top of a queue has been processing, by subtracting a time stamp from CT.

13. The programmable apparatus of claim 8 further comprising a subroutine in the load balancing program that sets N equal to 1, determines whether Q(N) is empty, responsive to a determination that Q(N) is empty, determines whether there is another device, responsive to a determination that there is another device, sets N equal to N plus 1, computes t, where t is a time that a request in a QI at a top of a queue has been processing, by subtracting a time stamp from CT, subtracts t from the QI's estimated completion time, determines whether the new estimated completion time is less than or equal to zero, and responsive to a determination that the new estimated completion time is less than or equal to zero, sets the estimated time to Z percent of the original estimated time.

14. The programmable apparatus of claim 8 further comprising a subroutine in the load balancing program identifies a cryptographic device associated with a QI with a completed request, determines

whether there are more QI's in queue for the cryptographic device, and responsive to a determination that there are more QI's in queue for the cryptographic device, calculating the current system time and assigning the current system time to the next QI's timestamp

15. A computer readable memory for causing a computer to balance the load of requests for cryptographic operations sent to a plurality of cryptographic devices comprising:

a memory;

a load balancing program stored in said memory;

the memory, so configured by said load balancing program, responsive to receiving a request for a cryptographic operation, causes the computer to determine a lowest  $T(N)$ , and send the cryptographic request to a cryptographic device with the lowest  $T(N)$ .

16. The computer readable memory of claim 15 wherein the load balancing program comprises an initialization subroutine in said load balancing program that causes said computer to set  $N$  equal to 1, set  $T(N)$  equal to 0, set  $Q(N)$  equal to 0.

17. The computer readable memory of claim 15 wherein the load balancing program comprises a subroutine in the load balancing program that sets  $CT$  equal to  $CST$  and updates all estimated QI completion times.

18. The computer readable memory of claim 15 wherein the load balancing program comprises a subroutine in the load balancing program that sets  $ET$  from an  $ET$  table, determines whether a QI is

the only QI in queue, and responsive to a determination that the QI is the only QI, sets the QI timestamp to CT.

19. The computer readable memory of claim 15 wherein the load balancing program comprises a subroutine in the load balancing program that computes  $t$  where  $t$  is a time a request in a QI at a top of a queue has been processing, by subtracting a time stamp from CT.

20. The computer readable memory of claim 15 wherein the load balancing program comprises a subroutine in the load balancing program that sets  $N$  equal to 1, determines whether  $Q(N)$  is empty, responsive to a determination that  $Q(N)$  is empty, determines whether there is another device, responsive to a determination that there is another device, sets  $N$  equal to  $N$  plus 1, computes  $t$ , where  $t$  is a time that a request in a QI at a top of a queue has been processing, by subtracting a time stamp from CT, subtracts  $t$  from the QI's estimated completion time, determines whether the new estimated completion time is less than or equal to zero, and responsive to a determination that the new estimated completion time is less than or equal to zero, sets the estimated time to  $Z$  percent of the original estimated time.

21. The computer readable memory of claim 15 wherein the load balancing program comprises a subroutine in the load balancing program identifies a cryptographic device associated with a QI with a completed request, determines whether there are more QI's in queue for the cryptographic device, and responsive to a determination that there are more QI's in queue for the cryptographic device, calculating the current system time and assigning the current system time to the next QI's timestamp

22. A computer implemented process to balance the load of requests for cryptographic operations sent to a plurality of cryptographic devices, comprising: using a computer, performing the following series of steps:

receiving a cryptographic request;

setting  $N$  equal to 1;

setting  $T(N)$  equal to 0;

setting  $Q(N)$  equal to 0;

determining whether  $Q(N)$  is empty;

responsive to a determination that  $Q(N)$  is empty, determining whether there is another device;

responsive to a determination that there is another device, setting  $N$  equal to  $N$  plus 1 and returning to the step of determining whether  $Q(N)$  is empty;

computing  $t$  where  $t$  is the time a request at the top of the queue has been processing by subtracting the time stamp from  $CT$ ;

subtracting  $t$  from the request's estimated completion time;

determining whether the new estimated completion time is less than or equal to zero;

responsive to a determination that the new estimated completion time is less than or equal to zero, setting the estimated time to  $Z$  percent of the original estimated time;

responsive to a determination that the new estimated time is greater than zero, determining whether there is another device to query;

responsive to determining that there is another device to query, returning to the step of

determining whether  $Q(N)$  is empty; and

identifying the device associated with the completed request;

determining whether there are more QIs in queue;

responsive to a determination that there are more QIs in queue, calculating the current system time and assigning the current system time to the next QI's timestamp;

setting CT equal to CST;

updating all estimated completion times;

determining the device with the lowest  $T(N)$ ; and

sending the cryptographic request to a device with the lowest  $T(N)$

23. The computer implemented process of claim 22 further comprising:

determining whether there is another device to query;

responsive to a determination that there is another device to query, setting N equal to N plus 1 and returning to the step of setting  $T(N)$  equal to 0.

determining whether there is a second cryptographic request;

responsive to a determination that there is a second cryptographic request, determining a new lowest  $T(N)$ ; and

sending the second cryptographic request to a cryptographic device with the lowest  $T(N)$ .